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## PATENT ABSTRACTS OF JAPAN

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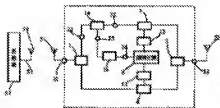
(22)Date of filing : 11.12.1995 (72)Inventor : NIKI YOSHIRO

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(54) BIDIRECTIONAL RELAY AMPLIFIER

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a stable bidirectional relay amplifier in which oscillation caused by sneak path is suppressed in the bidirectional communication using the same frequency.



SOLUTION: An outgoing amplifier 3 is set to ON and an incoming amplifier 4 is set to OFF. When a base station 57 sends a signal through a control channel, the signal is distributed in an outgoing direction by a circulator 1, detected by a coupling circuit

14 and given to a control circuit 9. The control circuit 9 extracts a frame synchronizing signal and a time slot signal or the like and recovers a synchronizing signal for time division simultaneous transmission reception and controls on/off of amplifier circuits 3, 4 via interface circuits 12, 13. On the other hand, when a signal from a mobile station 58 is received, the signal is distributed by a circulator 2 and sent to the base station via an amplifier 4 and the circulator 1.

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CLAIMS

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[Claim(s)]

[Claim 1]An opposite base station antenna which counters a base station of a time sharing duplex system, and an opposite mobile station antenna which counters a mobile station of a time sharing duplex system, A branch circuit for getting down with the uphill direction, and changing a direction, or branching, The going-up direction and an amplifying circuit for getting down and amplifying a signal of a radio frequency band of a direction, The going-up direction concerned or a detector circuit for getting down, and detecting or detecting a signal of a radio frequency band of a direction or its both directions, A bidirectional relay amplifier reproducing a synchronized signal from an output signal of the detector circuit concerned, and having the going-up direction and a control circuit for getting down and controlling a gain of an amplifier of a direction synchronizing with this.

[Claim 2]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent, wherein at least one side of the antenna concerned gets down with the uphill direction, is individually provided in a direction and is connected to a detector circuit or an amplifying circuit.

[Claim 3]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent to which it is characterized by the branch circuit concerned being constituted by a circulator, a hybrid circuit, an electronic switch, a directional coupler, or point and crossing.

[Claim 4]The detector circuit concerned chooses a control channel from the base station concerned, and a frame alignment signal and digital signals, such as a slot number, are detected, A bidirectional relay amplifier given in the 1st clause of a range of claim for patent which the control circuit concerned reproduces a time sharing simultaneous transmission-and-reception talk control signal, and is characterized by the going-up direction and getting down and performing gain control of an amplifier of a direction synchronizing with the signal concerned.

[Claim 5]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent which has a means by which the detector circuit concerned gets down with the uphill direction, and detects the directivity of a direction, detects a time slot

signal from the mobile station concerned, and is characterized by the going-up direction and getting down and performing gain control of an amplifier of a direction with the time slot signal concerned.

[Claim 6] A bidirectional relay amplifier given in the 1st clause of a range of claim for patent, wherein some or all of the amplifying circuit concerned gets down with the uphill direction and are provided in common in a direction.

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[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the bidirectional relay amplifier for carrying out relay amplification of the signal (a signal is called henceforth) of the radio frequency band emitted from the base station and mobile station of a time sharing duplex system.

[0002]

[Description of the Prior Art] Fig. 6 is the relay amplifier shown in JP, H6-216822, A

Fig. 1, for example. The circulator which (1) and (2) get down with the uphill direction, and branches a direction in a figure, (3) and (4) an amplifying circuit, (5), and (6) an input level detection circuit, (7), and (8) An output level detector circuit, A control circuit and (10) (9) FDMA/TDD (Frequency Division Multiplexing / time sharing simultaneous transmission-and-reception talk), The contact button of base stations (57), such as TDMA/TDD (Time Division Multiplexing / time sharing simultaneous transmission-and-reception talk) or a CDMA (code division multiplex / time sharing simultaneous transmission-and-reception talk) system (a time sharing duplex system is called below) (coaxial connector etc.), As for the coaxial cable to which (59) connects a base station (57) and a contact button (10), and (11), the contact button of an opposite mobile station antenna (52) and (58) are mobile stations. First, a base station (57) is a send state and presupposes that a mobile station (58) is in a receive state. Although the signal from a base station (57) branches by a circulator (1), it gets down and it is led to the amplifying circuit (3) of a direction, the gain of the amplifying circuit (4) of the uphill direction is decreased at the same time it increases the gain of an amplifying circuit (3), when it gets down and the input level detection circuit (5) of a direction detects said signal. Next, a mobile station (58) is a send state and presupposes that a base station (57) is in a receive state. It gets down, and the gain of the amplifying circuit (3) of a direction falls and a \*\*\*\* state is carried out. Although the signal from a mobile station (58) branches by a circulator (2) and it is led to the amplifying circuit (4) of the uphill direction, Unless the output level detector circuit (8) of the uphill direction detects a signal, the gain of the amplifying circuit (4) of the uphill direction is kept remaining as it is, but if the output level detector circuit (8) of the uphill direction detects a signal, the gain of the amplifying circuit (4) of the uphill direction will be decreased. From the value of an output level detector circuit (8), and the difference of an input level detection circuit (5), the degree which decreases the gain of an amplifying circuit (3) and (4) presumes the isolation of a circulator (2) adaptively, and opts for it.

[0003]

[Problem(s) to be Solved by the Device]since the conventional bidirectional relay amplifier is constituted as mentioned above, a base station or a mobile station exists in a remote place -- any -- although -- since the input signal from a base station or a mobile station is small when combined via an antenna, the device for ensuring detection or detection of an input signal is required. In this invention, it was made in order to improve the above problems.

Therefore, detect the frame alignment signal from a base station or a mobile station, and digital signals, such as time slot \*\*\*\*, and a simultaneous transmission-and-reception talk control signal is reproduced, It gets down with the uphill direction by a control circuit, the gain of the amplifier of a direction is controlled, and it aims at providing the bidirectional relay amplifier of the stable operation without an oscillation.

[004]

[Means for solving problem]The bidirectional relay amplifier concerning this invention so that the oscillation by surroundings lump may be oppressed and bidirectional relay amplification can be performed stably, the going-up direction and even when it gets down and both the signals of a direction are the same frequency like the signal of a time sharing duplex system, It gets down with the uphill direction, and the gain of the amplifier of a direction is changed by turns and controlled.

[0005]

[Function]In this invention, a simultaneous transmission-and-reception talk control signal is reproduced from the signal which contains a frame alignment signal, a time slot signal, or its both from the signal of the radio frequency band from a base station or a mobile station, Relay amplification can be carried out by getting down with the uphill direction by a control circuit, and controlling the gain of the amplifier of a direction, without oscillating, the going-up direction and even when it gets down and the signal of a direction is the same frequency.

[0006]

[Working example]Hereafter, one embodiment of this invention is described about a

figure. The branch circuit by the circulator etc. which (1) and (2) get down with the uphill direction, and branch a direction in Fig. 1, An amplifying circuit, (5) (5a) (5b), and (6) (3) and (4) An input level detection circuit, A control circuit, (10), and (11) (9) A contact button with an opposite base station antenna (51) and an opposite mobile station antenna (52), (53) and (50) The antenna cable and antenna of a base station (57), As for the interface circuit between a control circuit (9), an amplifying circuit (3), and (4), (21), (22), and (23), the contact button of a detector circuit (6) and (58) are mobile stations (12) and (13) the contact button of a detector circuit (5), (24), (25), and (26).

[0007]In Fig. 1, by a stationary state, it gets down and the amplifier (4) of the ON going-up direction is set as OFF for the amplifier (3) of a direction. First, from the base station (57) of a time sharing duplex system, if the signal of a radio frequency band is sent out from an antenna (50) on a control channel, This signal is received by the opposite base station antenna (51), and it gets down by the branch circuit (1) by a circulator etc., branches in a direction, and is detected by the input detecting circuit (5), and a detect output is passed to a control circuit (9). A control circuit (9) takes out a frame alignment signal, a time slot signal, etc. from the detected signal, reproduces the synchronized signal for the time sharing simultaneous transmission-and-reception talk, and controls a gain or ON/OFF for the amplifying circuit (3) and (4) through an interface circuit (12) and (13). On the other hand, if the signal from the mobile station (58) of a time sharing duplex system is received via an opposite mobile station antenna (52) and an antenna terminal (11), it will branch in the uphill direction by the branch circuit (2) by a circulator etc., and will be detected by the input detecting circuit (6). The detect output concerned is detected by the control circuit (9), amends or complements the above-mentioned synchronized signal, and controls an amplifying circuit (3) and the gain of (4), or ON/OFF through an interface circuit (12) and (13). That is [ although transmit frequency and received frequency are the same as a feature of a time sharing duplex system, / transmission and reception are not performed simultaneously ], it gets down with the uphill direction and a signal does not exist in a direction simultaneously.



Taking advantage of the feature of this time sharing duplex system, control an amplifying circuit (3) and the gain of (4) by the control circuit (9) of this invention adaptively, or ON/OFF of the power supply of an amplifying circuit (3) is controlled by it, There is a merit which can prevent the oscillation which gets down with the uphill direction and is generated by surroundings lump of a direction.

[0008]Fig. 2 is a block diagram showing the embodiment of the detector circuit of the bidirectional relay amplifier of this invention.

A level detection circuit (5a) comprises a filter (29) and a branch circuit (30), (5b) A low noise amplifier (31), a mixer (32), the oscillator from the First Bureau (33), It comprises the first intermediate frequency filter (34), the first intermediary frequency amplifier (35), a mixer (36), an oscillator from the Second Bureau (57), a second intermediate frequency filter (58), the second intermediary frequency amplifier (39), a decoder (40), and a reception input level detector circuit (41).

The oscillator from the First Bureau (33) usually comprises a synthesizer, and a channel is set up with the data from a terminal (23c). As for the signal which branched by the branch circuit (30), the radio frequency band signal from a base station (57) is changed into an intermediate frequency by the first mixer (32), It is chosen with the first intermediate frequency filter (34) and the second intermediate frequency filter (38), It is amplified by the low noise amplifier (33), the first cycle amplifier (35), and the second intermediary frequency amplifier (30), It is changed into a digital signal by the decoder (40), and a reception input level is detected by the detector circuit (41), and is sent to a control circuit (9) by the terminal (23a) from a terminal (23b).

[0009]Fig. 3 is a figure showing the example of the synchronized signal of this invention.

The signal (104) (105) (106) for getting down synchronizing with the control signal (101) (103) of a base station (57) or the time slot signal (102) from a mobile station (58), and turning on and off the power supply of the amplifier (3) of a direction and the going-up direction and (4) is reproduced.

[0010]Fig. 4 is a block diagram showing other embodiments of this invention.

An opposite base station antenna (51a) (51b) and an opposite mobile station antenna (52a) (52b) are formed, It becomes possible by keeping one's distance and installing each antenna to take the large degree of margin of the going-up direction and an oscillation can get down, can enlarge the isolation of a direction and according to an amplifier (3) and combination of (4).

[0011]Fig. 5 is a block diagram showing other embodiments of this invention.

A detector circuit (16) is connected via combination and a buffer circuit (14), and (15).

A detector circuit (16) has the going-up direction and a merit which gets down, can use now in common in a direction, and can attain economization by this example.

[0012]Although it presupposed that it gets down from a detector circuit and connects with the input terminal of the amplifying circuit of a direction and the going-up direction in the above explanation, an effect with the same said of either is acquired, and the same effect is acquired even if it provides in the middle of the output terminal of an amplifying circuit. Although a branch circuit shall be based on a circulator, the same effect is acquired even if it uses an electronic switch, a high Brit circuit, or a directional coupler. The same effect is acquired even if it constitutes a control circuit from DSP, a usual microcomputer, usual logical circuits, or these combination. Although an example was shown also about the control procedure, various control procedures can be considered by the disregard level or a detection output. Although it got down from the amplifying circuit with the uphill direction and being individually provided in the direction, all can also be used in common in part.

[0013]

[Effect of the Invention]Since this invention is constituted as mentioned above, it can expand the service area of a base station indoors etc. by a simple method.

[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Fig. 1] It is a block diagram showing the embodiment of this invention.

[Fig. 2] It is a block diagram showing the embodiment of the detector circuit of the bidirectional relay amplifier of this invention.

[Fig. 3] It is a figure showing the example of the synchronized signal of this invention.

[Fig. 4] It is a block diagram showing other embodiments of this invention.

[Fig. 5] It is a block diagram showing other embodiments of this invention.

[Fig. 6] It is a block diagram of the conventional bidirectional relay amplifier.

[Explanations of letters or numerals]

1 and 2 Circulator

3 Get down and it is an amplifying circuit of a direction.

4 The amplifying circuit of the uphill direction

5, 5a, 5b, and 6 Detector circuit

9 Control circuit

10, 10a, and 10b Bidirectional relay amplifier input terminal

11, 11a, and 11b Bidirectional relay amplifier output terminal  
12 and 13 Control circuit Interface Division  
14 and 15 Combination and buffer circuit  
16 Detector circuit  
21, 22, and 23 Contact button of a detector circuit (5)  
24, 25, and 26 Contact button of a detector circuit (6)  
29 Band pass filter  
30 Point and crossing  
31 Low noise amplifier  
32 and 36 Mixer  
33 and 37 From office  
34 and 38 Intermediate frequency filter  
35 and 39 Intermediary frequency amplifier  
40 Decoder  
41 Input level detection circuit  
50 Base station antenna  
51, 51a, and 51b Opposite base station antenna  
52, 52a, and 52b Opposite mobile station antenna  
53 Coaxial cable  
57 Base station  
58 Mobile station  
101, 102, and 103 Time slot of a radio frequency band signal  
104, 105, and 106 Control signal of an amplifying circuit

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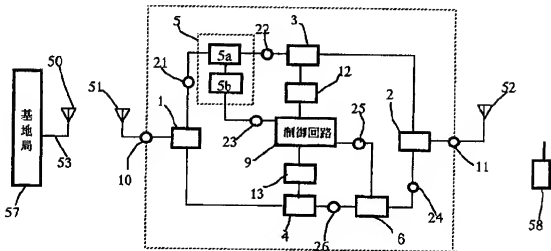
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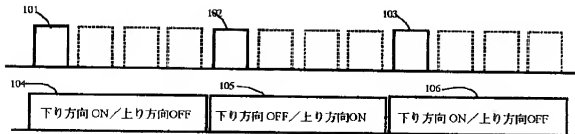
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## DRAWINGS

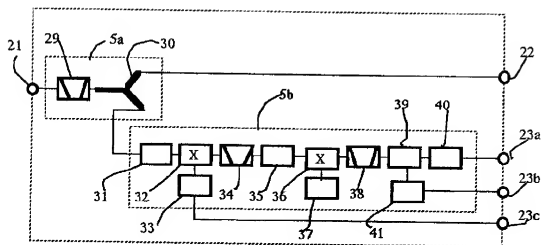
[Fig. 1]



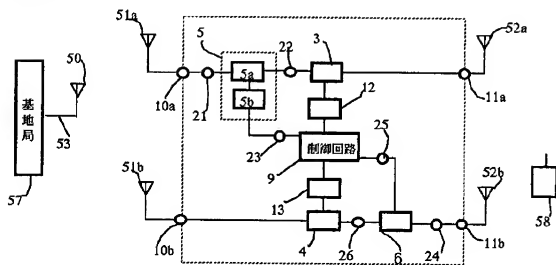
[Fig. 3]



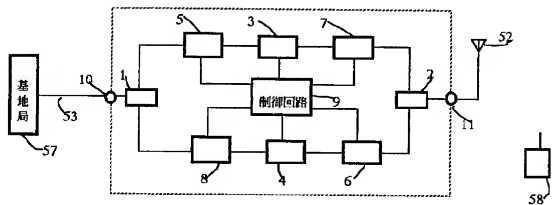
[Fig. 2]



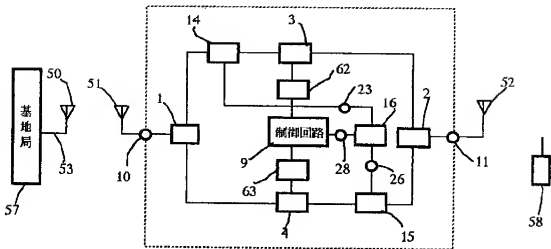
[Fig. 4]



[Fig. 6]



[Fig. 5]



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WRITTEN AMENDMENT

[Written Amendment]

[Filing date]Heisei 7(1995) December 24

[Amendment 1]

[Document to be Amended]Description

[Item(s) to be Amended]Whole sentence

[Method of Amendment]Change

[Proposed Amendment]

[Document Name]Description

[Title of the Invention]Bidirectional relay amplifier

[Claim(s)]

[Claim 1]A bidirectional relay amplifier comprising:

An opposite base station antenna which counters a base station of a time sharing duplex system.

An opposite mobile station antenna which counters a mobile station of a time sharing duplex system.

A branch circuit for getting down with the uphill direction, and changing a direction, or branching.

The going-up direction and an amplifying circuit for getting down and amplifying a signal of a radio frequency band of a direction, A synchronized signal is reproduced from an output signal of the going-up direction concerned or a detector circuit for getting down, and detecting or detecting a signal of a radio frequency band of a direction or its both directions, and the detector circuit concerned, it synchronizes with this, and they are the going-up direction and a control circuit for getting down and controlling an amplifier of a direction.

[Claim 2]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent, wherein at least one side of the antenna concerned gets down with the uphill direction, is individually provided in a direction and is connected to a detector circuit or an amplifying circuit.

[Claim 3]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent to which it is characterized by the branch circuit concerned being constituted by a circulator, a hybrid circuit, an electronic switch, a directional coupler, or point and crossing.



[Claim 4]The detector circuit concerned chooses a control channel from the base station concerned, and a frame alignment signal and digital signals, such as a slot number, are detected, A bidirectional relay amplifier given in the 1st clause of a range of claim for patent which the control circuit concerned reproduces a time sharing simultaneous transmission-and-reception talk control signal, and is characterized by the going-up direction and getting down and performing gain control of an amplifier of a direction synchronizing with the signal concerned.

[Claim 5]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent which has a means by which the detector circuit concerned gets down with the uphill direction, and detects the directivity of a direction, detects a time slot signal from the mobile station concerned, and is characterized by the going-up direction and getting down and performing gain control of an amplifier of a direction with the time slot signal concerned.

[Claim 6]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent, wherein some or all of the amplifying circuit concerned gets down with the uphill direction and are provided in common in a direction.

[Claim 7]A bidirectional relay amplifier given in the 1st clause of Claims that is provided with the following and to which means concerned to detect, and a means to send out are characterized by the thing [ getting down and sharing some or all of an amplifier of a direction or the going-up direction ] concerned.

A means to detect a digital signal from the base station concerned.

A means to send out a digital signal to the base station concerned.

[Claim 8]A bidirectional relay amplifier given in the 1st clause of a range of claim for patent, wherein a means to send out a digital signal to the base station concerned answers a signal from the base station concerned or sends out a digital signal in scheduled time.

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the bidirectional relay amplifier

for carrying out relay amplification of the signal (a signal is called henceforth) of the radio frequency band emitted from the base station and mobile station of a time sharing duplex system.

[0002]

[Description of the Prior Art]Fig. 8 is the relay amplifier shown in JP, H6-216822, A Fig. 1, for example. The circulator which (1) and (2) get down with the uphill direction, and branches a direction in a figure, (3) and (4) an amplifying circuit, (5), and (6) an input level detection circuit, (7), and (8) An output level detector circuit, A control circuit and (10) (9) FDMA/TDD (Frequency Division Multiplexing / time sharing simultaneous transmission-and-reception talk), The contact button of base stations (57), such as TDMA/TDD (Time Division Multiplexing / time sharing simultaneous transmission-and-reception talk) or a CDMA (code division multiplex / time sharing simultaneous transmission-and-reception talk) system (a time sharing duplex system is called below) (coaxial connector etc.), As for the coaxial cable to which (53) connects a base station (57) and a contact button (10), and (11), the contact button of an opposite mobile station antenna (52) and (58) are mobile stations. First, a base station (57) is a send state and presupposes that a mobile station (58) is in a receive state. Although the signal from a base station (57) branches by a circulator (1), it gets down and it is led to the amplifying circuit (3) of a direction, the gain of the amplifying circuit (4) of the uphill direction is decreased at the same time it increases the gain of an amplifying circuit (3), when it gets down and the input level detection circuit (5) of a direction detects said signal. Next, a mobile station (58) is a send state and presupposes that a base station (57) is in a receive state. It gets down, and the gain of the amplifying circuit (3) of a direction falls and a \*\*\*\* state is carried out. Although the signal from a mobile station (58) branches by a circulator (2) and it is led to the amplifying circuit (4) of the uphill direction, Unless the output level detector circuit (8) of the uphill direction detects a signal, the gain of the amplifying circuit (4) of the uphill direction is kept remaining as it is, but if the output level detector circuit (8) of the uphill direction detects a signal, the gain of the amplifying circuit (4) of the uphill

direction will be decreased. From the value of an output level detector circuit (8), and the difference of an input level detection circuit (5), the degree which decreases the gain of an amplifying circuit (3) and (4) presumes the isolation of a circulator (2) adaptively, and opts for it.

[0003]

[Problem(s) to be Solved by the Device]since the conventional bidirectional relay amplifier is constituted as mentioned above, a base station or a mobile station exists in a remote place -- any -- although -- since the input signal from a base station or a mobile station is small when combined via an antenna, the device for ensuring detection or detection of an input signal is required. In this invention, it was made in order to improve the above problems.

Therefore, detect the frame alignment signal and the digital signal which included the slot signal etc. absolutely from a base station or a mobile station, and a simultaneous transmission-and-reception talk control signal is reproduced. It gets down with the uphill direction by a control circuit, the gain of the amplifier of a direction is controlled, and it aims at providing the bidirectional relay amplifier of the stable operation without an oscillation.

[0004]

[Means for solving problem]The bidirectional relay amplifier concerning this invention so that the oscillation by surroundings lump may be oppressed and bidirectional relay amplification can be performed stably, the going-up direction and even when it gets down and both the signals of a direction are the same frequency like the signal of a time sharing duplex system, It gets down with the uphill direction, and the gain of the amplifier of a direction is changed by turns and controlled.

[0005]

[Function]In this invention, a simultaneous transmission-and-reception talk control signal is reproduced from the signal which contains a frame alignment signal, a time slot signal, or its both from the signal of the radio frequency band from a base station or a mobile station, Relay amplification can be carried out by getting down with the

uphill direction by a control circuit, and controlling the gain of the amplifier of a direction, without oscillating, the going-up direction and even when it gets down and the signal of a direction is the same frequency.

[0006]

[Working example]one embodiment of the following and this invention -- a figure --  
\*\*\*\* -- it explains. The branch circuit by the circulator etc. which (1) and (2) get down with the uphill direction, and branch a direction in Fig. 1, (3) and (4) an amplifying circuit and (14) the coupled circuit of an input level, and (9) A control circuit, (10) and (11) A contact button with an opposite base station antenna (51) and an opposite mobile station antenna (52), The antenna cable of a base station (57) and (50) (53) The antenna of a base station (57), As for a digital signal detector circuit, (21), (22), and (23), (12) and (13) are [ the contact button of a detector circuit (16) and (58) ] mobile stations the contact button of a coupled circuit (14), and (24) the interface circuit between a control circuit (9), an amplifying circuit (3), and (4), and (16).

[0007]In Fig. 1, by a stationary state, it gets down and the amplifier (4) of ON and the going-up direction is set as OFF for the amplifier (3) of a direction. First, from the base station (57) of a time sharing duplex system, if the signal of a radio frequency band is sent out from an antenna (50) on a control channel, This signal is received by the opposite base station antenna (51), and it gets down by the branch circuit (1) by a circulator etc., branches in a direction, and is combined by the coupling circuit (14), a digital signal is detected by the detector circuit (16), and the detect output concerned is passed to a control circuit (9). A control circuit (9) takes out a frame alignment signal, an absolute slot signal, etc. from the detected signal, reproduces the synchronized signal for the time sharing simultaneous transmission-and-reception talk, and controls a gain or ON/OFF for the amplifying circuit (3) and (4) through an interface circuit (12) and (13). On the other hand, if the signal from the mobile station (58) of a time sharing duplex system is received via an opposite mobile station antenna (52) and an antenna terminal (11), It branches in the uphill direction by the branch circuit (2) by a circulator etc., and it is

amplified by an amplifier (4), it branches by the branch circuit (1) by a circulator etc., and is sent out from an opposite base station antenna (51). That is [ although transmit frequency and received frequency are the same as a feature of a time sharing duplex system, / transmission and reception are not performed simultaneously ], it gets down with the uphill direction and a signal does not exist in a direction simultaneously. Taking advantage of the feature of this time sharing duplex system, control an amplifying circuit (3) and the gain of (4) by the control circuit (9) of this invention adaptively, or ON/OFF of an amplifying circuit (3) and the power supply of (4) is controlled by it, There is a merit which can prevent the oscillation which gets down with the uphill direction and is generated by surroundings lump of a direction.

[0008]Fig. 2 is a block diagram showing the embodiment of the detector circuit of the bidirectional relay amplifier of this invention.

A coupled circuit (5) comprises a filter (29) and a branch circuit (30), A digital signal detector circuit (16) A low noise amplifier (31), a mixer (32), It comprises an oscillator from an office (33), an intermediate frequency filter (34), an intermediary frequency amplifier (35) decoder (36) and its output terminal (24a), a reception input level detector circuit (37), and its output terminal (24b).

The oscillator from an office (33) usually comprises a synthesizer, and a channel is set up with the data from a terminal (24c). The signal which branched by the branch circuit (30) is amplified by a low noise amplifier (33), The radio frequency band signal from a base station (57) is changed into an intermediate frequency by the mixer (32), It is chosen with an intermediate frequency filter (34), is amplified by an intermediary frequency amplifier (35), and is changed into a digital signal by the decoder (36), and a reception input level is detected by the detector circuit (37), and is sent to a control circuit (9) by the terminal (24a) from a terminal (24b).

[0009]Fig. 3 is a figure showing the example of the synchronized signal of this invention.

The signal (104) (105) (106) for getting down synchronizing with the control signal (101) (103) of a base station (57) or the time slot signal (102) from a mobile station

(58), and turning on and off the power supply of the amplifier (3) of a direction and the going-up direction and (4) is reproduced.

[0010]Fig. 4 is a block diagram showing other embodiments of this invention.

An opposite base station antenna (51a) (51b) and an opposite mobile station antenna (52a) (52b) are formed, It becomes possible by keeping one's distance and installing each antenna to take the large degree of margin of the going-up direction and an oscillation can get down, can enlarge the isolation of a direction and according to an amplifier (3) and combination of (4).

[0011]Fig. 5 is a block diagram showing other embodiments of this invention.

A detector circuit (16) is connected via a coupled circuit (14) and (15).

It gets down with the uphill direction by this example, the digital signal of a direction can be detected, and there is a merit which a detector circuit (16) can use now in common the going-up direction and by getting down and changing in a direction, and can moreover attain economization.

[0012]Fig. 6 is a block diagram showing other embodiments of this invention.

Detection and the transmission circuit of a digital signal (39) are connected via a coupled circuit (14) and (15).

Detection and the transmission circuit of this example (39) detect the digital signal from a base station (57), and also answers the supervisory signal from a base station (57), for example, and has a means to transmit a digital signal in the uphill direction via a contact button (27), a coupler (15), and the amplifier (4) of the uphill direction. Since it will get down from an opposite base station antenna (51) and will be connected via the amplifier (3) of a direction, and the amplifier (4) of the uphill direction, detection and the transmission circuit concerned (39) have a merit which can perform the operation check of the bidirectional relay amplifier concerned simultaneously.

[0013]Fig. 7 is a block diagram showing the embodiment of detection and the transmission circuit of this invention (39).

It is chosen by BPF (29a) via the contact button (23) of a coupled circuit (14), It is amplified by a low noise amplifier (31a), and is changed into an intermediate frequency by the oscillator from an office (33), and the mixer (32a), It is chosen with an intermediate frequency filter (34), is amplified by an intermediary frequency amplifier (35), and is changed into a digital signal by the decoder (36), and a reception input level is detected by the detector circuit (37), and is sent to a control circuit (9) by the terminal (28a) from a terminal (28b).

On the other hand, the digital signal sent out towards a base station (57) from a control circuit (9), A seal of approval is carried out from the contact button (28a) of a coupled circuit (15), and the modulation circuit (38) of a digital signal becomes irregular, It is changed into a radio signal by the oscillator from an office (33), and the mixer (32b), and is combined with a coupler (6) via a power amplifier (31b), BPF (29b), and a terminal (27). The frequency of the oscillating circuit from an office (33) is set up by the channel designation signal from a control circuit (9). He can understand that get down and the amplifier (3) of a direction and the amplifier (4) of the uphill direction constitute a part of detector circuit of a digital signal, and transmission circuit by this composition.

[0014]Although it presupposed that it gets down from the detector circuit of a digital signal, and connects with the input terminal of the amplifying circuit of a direction in the above explanation, it gets down and an effect also with same also connecting with one of a direction and the going-up directions or both is acquired, and the same effect is acquired even if it provides in the middle of the output terminal of the amplifying circuit concerned. Although a branch circuit shall be based on a circulator, the same effect is acquired even if it uses an electronic switch, a high Brit circuit, or a directional coupler. The same effect is acquired even if it constitutes a control circuit from DSP, a microcomputer, logical circuits, or these combination. Although an example was shown also about the control procedure, various control procedures can be considered by the disregard level or a detection output. Although it got down from the amplifying circuit with the uphill direction and being individually provided in the direction, all can also be used in common in part. The typical thing is shown

about the composition or the function of detection and a transmission circuit of the digital signal, other composition or functions can be adopted, and an insertion location is not this limitation, either.

[0015]

[Effect of the Invention] Since this invention is constituted as mentioned above, it can expand the service area of a base station indoors etc. by a simple method, and the operation check of a bidirectional relay amplifier of it becomes possible.

[Brief Description of the Drawings]

[Fig. 1] It is a block diagram showing the embodiment of this invention.

[Fig. 2] It is a block diagram showing the embodiment of the detector circuit of the bidirectional relay amplifier of this invention.

[Fig. 3] It is a figure showing the example of the synchronized signal of this invention.

[Fig. 4] It is a block diagram showing other embodiments of this invention.

[Fig. 5] It is a block diagram showing other embodiments of this invention.

[Fig. 6] It is a block diagram showing other embodiments of this invention.

[Fig. 7] It is a block diagram showing the embodiment of detection and the transmission circuit of this invention.

[Fig. 8] It is a block diagram of the conventional bidirectional relay amplifier.

[Explanations of letters or numerals]

1 and 2 Point and crossings, such as a circulator

3 Get down and it is an amplifying circuit of a direction.

4 The amplifying circuit of the uphill direction

5, six detector circuits

9 Control circuit

10, 10a, and 10b Bidirectional relay amplifier input terminal

11, 11a, and 11b Bidirectional relay amplifier output terminal

12 and 13 Control circuit Interface Division

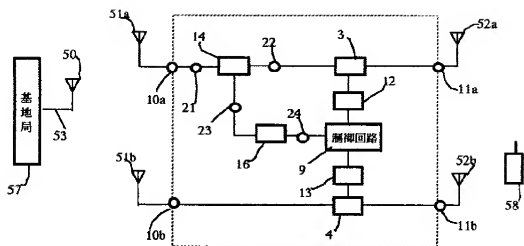
14, 15 coupled circuits

16 DESHITARU signal detection circuit

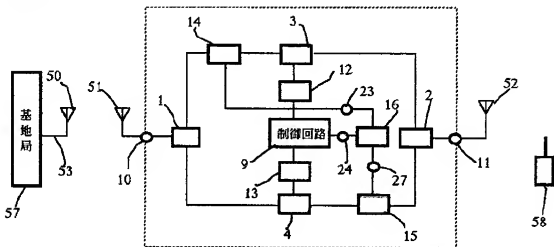


The contact button of 21, 22, and 23 coupled circuits (14)  
24a, 24b, and 24c Contact button of a control circuit (9)  
25, 26, and 27 Contact button of a coupled circuit (15)  
28, 28a, 28b, the contact button of a control circuit (9)  
28c and 28d Same as the above  
29, 29a, 29b band pass filter  
30 Point and crossing  
31, 31a, and 31b Low noise amplifier  
32, 32a, and 32b Mixer  
33 A from office  
34 intermediate-frequency filter  
35 intermediary frequency amplifiers  
36 Decoder  
37 Input level detection circuit  
38 Digital modulation circuit  
39 Detection and a transmission circuit  
50 Base station antenna  
51, 51a, and 51b Opposite base station antenna  
52, 52a, and 52b Opposite mobile station antenna  
53 Coaxial cable  
57 Base station  
58 Mobile station  
101, 102, and 103 Time slot of a radio frequency band signal  
104, 105, and 106 Control signal of an amplifying circuit  
[Amendment 2]  
[Document to be Amended]DRAWINGS  
[Item(s) to be Amended]Complete diagram  
[Method of Amendment]Change  
[Proposed Amendment]  
[Fig. 1]

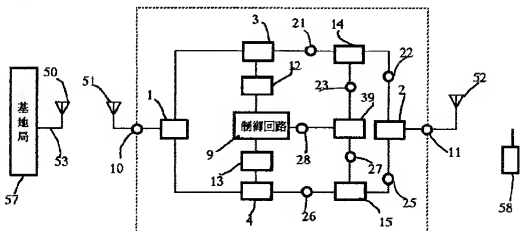




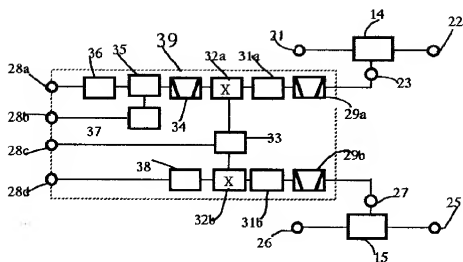
[Fig. 5]



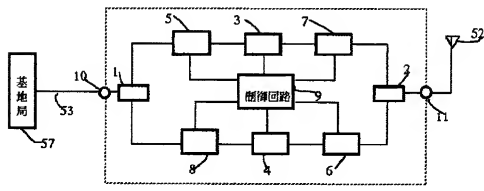
[Fig. 6]



[Fig. 7]



[Fig. 8]



----- [Written Amendment]

[Filing date]Heisei 8(1996) January 2

[Amendment 1]

[Document to be Amended]Description

[Item(s) to be Amended]0013

[Method of Amendment]Change

[Proposed Amendment]

[0013]Fig. 7 is a block diagram showing the embodiment of detection and the transmission circuit of this invention (39).

After the digital signal sent out from the base station passes along point and crossing

(2), via the contact button (23) of the coupled circuit (14) provided in common and (15), and (27), It is chosen by BPF (29a) (29b) similarly provided in common, A switching circuit (40) changes and it is changed into an intermediate frequency by the oscillator from an office (33), and the mixer (32a), It is chosen with an intermediate frequency filter (34), is amplified by an intermediary frequency amplifier (35), and is changed into a digital signal by the decoder (36), and a reception input level is detected by the detector circuit (37), and is still sent to a control circuit (9) by the terminal (28a) from a terminal (28b).

On the other hand, the digital signal sent out towards a base station (57) from a control circuit (9), A seal of approval is carried out from a contact button (28d), and the modulation circuit (38) of a digital signal becomes irregular, It is changed into a radio signal by the oscillator from an office (33), and the mixer (32b), a switching circuit (40) changes, and it is chosen by BPF (29a) (29b) provided in common, and via a terminal (23) and (27), It is combined with the coupler (14) and (15) similarly provided in common, and after passing along point and crossing (2), it is amplified by the amplifier (4) of the uphill direction. The frequency of the oscillating circuit from an office (33) is set up by the channel designation signal from a control circuit (9). He can understand that get down and the amplifier (3) of a direction and the amplifier (4) of the uphill direction constitute a part of detector circuit of a digital signal, and transmission circuit by this composition. It turns out that a coupler (14), (15), and BPF (29a) (29b) are provided in common as compared with Fig. 6, and the switching circuit (40) changes.

[Amendment 2]

[Document to be Amended]Description

[Item(s) to be Amended]0014

[Method of Amendment]Change

[Proposed Amendment]

[0014]Although it presupposed that it gets down from the detector circuit of a digital signal, and connects with the input terminal of the amplifying circuit of a direction in the above explanation, it gets down and an effect also with same also connecting

with one of a direction and the going-up directions or both is acquired, and the same effect is acquired even if it provides in the middle of the output terminal of the amplifying circuit concerned. Although a branch circuit shall be based on a circulator, the same effect is acquired even if it uses an electronic switch, a high Brit circuit, or a directional coupler. The same effect is acquired even if it constitutes a control circuit from DSP, a microcomputer, logical circuits, or these combination. Although an example was shown also about the control procedure, various control procedures can be considered by the disregard level or a detection output. Although it got down from the amplifying circuit with the uphill direction and being individually provided in the direction, all can also be used in common in part. The typical thing is shown about the composition or the function of detection of a digital signal, or a transmission circuit, other composition or functions can be adopted, and combination or an insertion location is not this limitation, either.

[Amendment 3]

[Document to be Amended]Description

[Item(s) to be Amended]Explanations of letters or numerals

[Method of Amendment]Change

[Proposed Amendment]

[Explanations of letters or numerals]

1 and 2 Point and crossings, such as a circulator

3 Get down and it is an amplifying circuit of a direction.

4 The amplifying circuit of the uphill direction

5 and 6 Detector circuit

9 Control circuit

10, 10a, and 10b Bidirectional relay amplifier input terminal

11, 11a, and 11b Bidirectional relay amplifier output terminal

12 and 13 Control circuit Interface Division

14 and 15 Coupled circuit

16 Digital signal detector circuit

21, 22, and 23 Contact button of a coupled circuit (14)

24a, 24b, and 24c Contact button of a control circuit (9)

25, 26, and 27 Contact button of a coupled circuit (15)

28, 28a, 28b, the contact button of a control circuit (9)

28c and 28d Same as the above

29, 29a, 29b band pass filter

30 Point and crossing

31, 31a, and 31b Low noise amplifier

32, 32a, and 32b Mixer

33 A from office

34 Intermediate frequency filter

35 Intermediary frequency amplifier

36 Decoder

37 Input level detection circuit

38 Digital modulation circuit

39 Detection and a transmission circuit

40 Switching circuit

50 Base station antenna

51, 51a, and 51b Opposite base station antenna

52, 52a, and 52b Opposite mobile station antenna

53 Coaxial cable

57 Base station

58 Mobile station

101, 102, and 103 Time slot of a radio frequency band signal

104, 105, and 106 Control signal of an amplifying circuit

[Amendment 4]

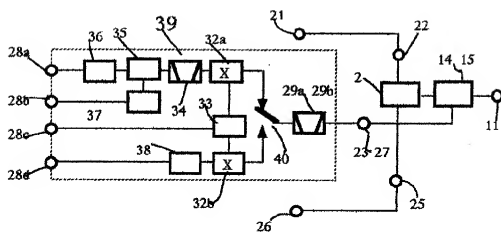
[Document to be Amended]DRAWINGS

[Item(s) to be Amended]Fig. 7

[Method of Amendment]Change

[Proposed Amendment]

[Fig. 7]



[Translation done.]



# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : R C S:KK

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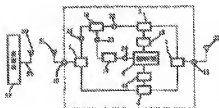
(72)Inventor : NIKI YOSHIRO

## (54) BIDIRECTIONAL RELAY AMPLIFIER

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a stable bidirectional relay amplifier in which oscillation caused by sneak path is suppressed in the bidirectional communication using the same frequency.

**SOLUTION:** An outgoing amplifier 3 is set to ON and an incoming amplifier 4 is set to OFF. When a base station 57 sends a signal through a control channel, the signal is distributed in an outgoing direction by a circulator 1, detected by a coupling circuit 14 and given to a control circuit 9. The control circuit 9 extracts a frame synchronizing signal and a time slot signal or the like and recovers a synchronizing signal for time division simultaneous transmission reception and controls on/off of amplifier circuits 3, 4 via interface circuits 12, 13. On the other hand, when a signal from a mobile station 58 is received, the signal is



distributed by a circulator 2 and sent to the base station via an amplifier 4 and the circulator 1.

(19) 日本国特許庁 (J P)

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H 0 3 F 3/62			H 0 3 F 3/62	
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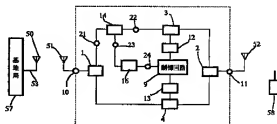
名古屋市中千種区鹿子蔵13-A-111

(54) 【発明の名称】 双方向中継増幅器

(57) 【要約】 (修正有)

【課題】同一周波数を用いた双方向通信において回り込みによる発振を抑えた安定な双方向中継増幅器を提供する。

【解決手段】 下り方向の増幅器3をON上り方向の増幅器4をOFFに設定する。基地局57から制御チャネル上で信号を送出すると、この信号はサーキュレータ1により下り方向に分岐され、結合回路14により検出され制御回路9に渡される。制御回路9はフレーム同期信号および時間スロット信号等を取り出し、時分割同時送受話のための同期信号を再生し、インターフェイス回路12、13を通じて増幅回路3および4をON/OFF制御する。一方、移動局58からの信号が受信されると、サーキュレータ2により分岐され増幅器4、サーキュレータ1を介して基地局へ送出される。



【特許請求の範囲】

【請求項1】 時分割同時送受方式の基地局に対向する対基地局アンテナと、時分割同時送受方式の移動局に対向する対移動局アンテナと、上り方向と下り方向を切り替えあるいは分岐するための分岐回路と、上り方向および下り方向の無線周波数帯の信号を増幅するための増幅回路と、当該上り方向あるいは下り方向あるいはその両方向の無線周波数帯の信号を検波あるいは検出するための検出回路と、当該検出回路の出力信号から同期信号を再生しこれに同期して上り方向および下り方向の増幅器の利得を制御するための制御回路とを有することを特徴とする双方向中継増幅器。

【請求項2】 当該アンテナの少なくとも一方が、上り方向と下り方向に個別に設けられ、検出回路あるいは増幅回路に接続されることを特徴とする特許請求の範囲第1項に記載の双方向中継増幅器。

【請求項3】 当該分岐回路が、サーキュレーター、ハイブリッド回路、電子スイッチ、方向性結合器、あるいは分岐器により構成されることを特徴とする特許請求の範囲第1項に記載の双方向中継増幅器。

【請求項4】 当該検出回路が当該基地局からの制御チャネルを選択してフレーム同期信号とスロット番号等のデジタル信号を検出し、当該制御回路が時分割同時送受制御信号を再生し、当該信号に同期して上り方向および下り方向の増幅器の利得制御を行うことを特徴とする特許請求の範囲第1項に記載の双方向中継増幅器。

【請求項5】 当該検出回路が上り方向と下り方向の方向性を検出する手段を有し、当該移動局からの時間スロット信号を検出し、当該時間スロット信号により上り方向および下り方向の増幅器の利得制御を行うことを特徴とする特許請求の範囲第1項に記載の双方向中継増幅器。

【請求項6】 当該増幅回路の一部あるいは全部が、上り方向と下り方向で共通に設けられることを特徴とする特許請求の範囲第1項に記載の双方向中継増幅器。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 この発明は、時分割同時送受方式の基地局および移動局から発せられる無線周波数帯の信号（以後信号と称する）を中継増幅するための双方向中継増幅器に関するものである。

【0002】

【従来の技術】 第6図は、例えば、特開平6-216822号 第1図に示された中継増幅器である。図において、（1）（2）は上り方向と下り方向の分岐を行うサーキュレーター、（3）（4）は増幅回路、（5）

（6）は入力レベル検出回路、（7）（8）は出力レベル検出回路、（9）は制御回路、（10）はFDMA/TDD（周波数分割多重/時分割同時送受）、TDDMA/TDD（時分割多重/時分割同時送受）、あるいはCDMA（コード分割多重/時分割同時送受）方式

等（以下時分割同時送受方式と称する）の基地局（57）の接続端子（同軸コネクタ等）、（59）は基地局（57）と接続端子（10）を接続する同軸ケーブル、（11）は対移動局アンテナ（52）の接続端子、（58）は移動局である。先ず、基地局（57）が送信状態であり移動局（58）が受信状態にあるとする。基地局（57）からの信号はサーキュレーター（11）によって分岐され下り方向の増幅回路（3）に導かれるが、下り方向の入力レベル検出回路（5）が前記信号を検出した時点で増幅回路（3）の利得を増加すると同時に上り方向の増幅回路（4）の利得を減少させる。次に、移動局（58）が送信状態であり基地局（57）が受信状態にあるとする。下り方向の増幅回路（3）の利得は低下した状態である。移動局（58）からの信号はサーキュレーター（2）によって分岐され上り方向の増幅回路（4）に導かれるが、上り方向の出力レベル検出回路（8）が信号を検出しないかぎり上り方向の増幅回路（4）の利得をそのままに保つが、上り方向の出力レベル検出回路（8）が信号を検出すると上り方向の増幅回路（4）の利得を減少させる度合は、出力レベル検出回路（8）の値と入力レベル検出回路（5）の差からサーキュレーター（2）のアイソレーションをアダプティブに推定して決める。

【0003】

【考案が解決しようとする課題】 従来の双方向中継増幅器は以上のように構成されているので、基地局あるいは移動局が遠隔地に存在し何れもがアンテナとして結合される場合には、基地局あるいは移動局からの入力信号が小さいため、入力信号の検波あるいは検出を確実にするための工夫が必要である。この発明は、上記のような問題点を改善するためになされたもので、基地局あるいは移動局からのフレーム同期信号と時間スロット信号等のデジタル信号を検出して同時送受制御信号を再生し、制御回路により上り方向と下り方向の増幅器の利得の制御を行い、発振の無い安定な動作の双方向中継増幅器を提供することを目的とする。

【0004】

【課題を解決するための手段】 この発明に係る双方向中継増幅器は、時分割同時送受方式の信号のようにより上り方向および下り方向の信号がともに同一周波数の場合でも、回り込みによる発振を抑制して安定に双方向の中継増幅が出来るよう、上り方向と下り方向の増幅器の利得を交互に切り替えて制御する。

【0005】

【作用】 この発明において、基地局あるいは移動局からの無線周波数帯の信号からフレーム同期信号あるいは時間スロット信号あるいはその両方を含む信号から同時送受制御信号を再生し、制御回路により上り方向と下り方向の増幅器の利得を制御することにより上り方向およ

び下り方向の信号が同一周波数の場合でも発振せずに中継増幅することが出来る。

【0006】

【実施例】以下、この発明の一実施例を図について説明する。第1図において、(1)(2)は上り方向と下り方向の分岐を行うサーキュレーター等による分岐回路、

(3)(4)は増幅回路、(5)(5a)(5b)

(6)は入力レベル検出回路、(9)は制御回路、(10)

(11)は対基地局アンテナ(51)および対移動局アンテナ(52)との接続端子、(53)(50)は

基地局(57)のアンテナケーブルおよびアンテナ、

(12)(13)は制御回路(9)と増幅回路(3)

(4)の間のインターフェイス回路、(21)(22)

(23)は検出回路(5)の接続端子、(24)(2

5)(26)は検出回路(6)の接続端子、(58)は

移動局である。

【0007】第1図において、定常状態では下り方向の増幅器(3)をON上り方向の増幅器(4)をOFFに

設定する。まず、時分割同時送受話方式の基地局(5

7)から制御チャンネル上で無線周波数帯の信号をアン

テナ(50)から送出すると、この信号が対基地局アン

テナ(51)で受信され、サーキュレーター等による分岐

回路(1)により下り方向に分岐され、入力検出回路

(5)により検出され、検出出力が制御回路(9)に渡

される。制御回路(9)は検出された信号からフレーム

同期信号および時間スロット信号等を取り出し、時分割

同時送受話のための同期信号を再生し、インターフェ

イス回路(12)(13)を通じて増幅回路(3)および

(4)を利得あるいはON/OFFを制御する。一方、

時分割同時送受話方式の移動局(58)からの信号が対

移動局アンテナ(52)およびアンテナ端子(11)を

経由して受信されると、サーキュレーター等による分岐

回路(2)により上り方向に分岐され、入力検出回路

サ(32)、第一局発振器(33)、第一中間周波

フィルタ(34)、第一中間周波増幅器(35)、ミ

キサ(36)、第二局発振器(57)、第二中間周

波フィルタ(58)、第二中間周波増幅器(39)、

デコーダ(40)、受信入力レベル検出回路(41)から

構成される。なお、第一局発振器(33)は通常シ

ンセサイザで構成され、端子(23c)からのデータ

によりチャネルが設定される。分岐回路(30)により

分岐された信号は第一ミキサ(32)により基地局

(57)からの無線周波数帯信号が中間周波数に変換さ

れ、第一中間周波フィルタ(34)および第二中間

周波フィルタ(38)により選択され、低雑音増幅器

(33)、第一周波増幅器(35)および第二中間周波

増幅器(30)により増幅され、デコーダ(40)により

デジタル信号に変換されて端子(23a)から、ま

た、受信入力レベルが検出回路(41)によって検出さ

れて端子(23b)から制御回路(9)に送られる。

【0009】第3図は、本発明の同期信号の例を示す図

であり、基地局(57)の制御信号(101)(10

3)あるいは移動局(58)からの時間スロット信号

(102)に同期して下り方向および上り方向の増幅器

(3)(4)の電源をON/OFFするための信号(1

04)(105)(106)が再生される。

【0010】第4図は、本発明の他の実施例を示す構成

図であり、対基地局アンテナ(51a)(51b)およ

び対移動局アンテナ(52a)(52b)が設けられ、

各々のアンテナを距離を置いて設置することによって上

り方向および下り方向のアイソレーションを大きくす

ることができ、増幅器(3)および(4)の結合による発

振の余裕度を大きくすることが可能となる。

【0011】第5図は、本発明の他の実施例を示す構成

図であり、結合・緩衝回路(14)(15)を介して検

出回路(16)が接続される。本実施例により検出回路

(16)が上り方向および下り方向で共通に使えるよう

になり経済化が図れるメリットがある。

【0012】以上の説明では、検出回路は下り方向と

上り方向の増幅回路の入力端子に接続するとしたが、ど

ちか一方でも同様な効果が得られ、また、増幅回路の出

力端子あるいは途中に設けて同様な効果が得られる。

また、分岐回路はサーキュレーターによるものとし

たが、電子スイッチ、ハイブリット回路、あるいは方向性

結合器等を用いても同様な効果が得られる。また、制御

回路は、DSP、通常のマイコン、あるいは通常のロジ

ック回路あるいはこれらの組合せで構成しても同様な効

果が得られる。制御手順についても一例を示した検出

レベルあるいは検波出力により種々の制御手順が考えら

れる。また、増幅回路は上り方向と下り方向で個別に設

けたが、一部あるいは全部を共通に使用することもでき

る。

【0013】

【発明の効果】本発明は、上記のように構成されるため、基地局のサービスエリアを簡易な方法により屋内等に拡大することができる。

【図面の簡単な説明】

【第1図】本発明の実施例を示す構成図である。

【第2図】本発明の双方向中継増幅器の検出回路の実施例を示す構成図である。

【第3図】本発明の同期信号の例を示す図である。

【第4図】本発明の他の実施例を示す構成図である。

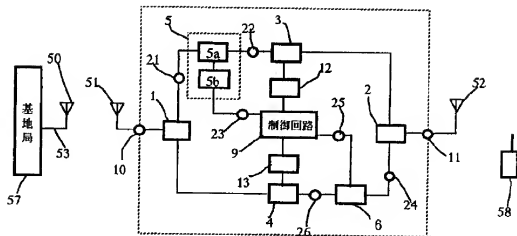
【第5図】本発明の他の実施例を示す構成図である。

【第6図】従来の双方向中継増幅器の構成図である。

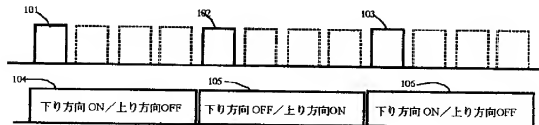
【符号の説明】

1、2	サーキュレーター	50	検出回路
3	下り方向の増幅回路	51、51a、51b	検出回路(5)の接続端子
4	上り方向の増幅回路	52、52a、52b	検出回路(6)の接続端子
5、5a、5b、6	検出回路	53	帯域通過フィルター
9	制御回路	57	ミキサ
10、10a、10b	双方向中継増幅器入力端子	58	局発
11、11a、11b	双方向中継増幅器出力端子	101、102、103	中間周波フィルター
12、13	制御回路インターフェイス	20	中間周波増幅器
14、15	結合・緩衝回路	*	デコーダ
		104、105、106	入力レベル検出回路
			基地局アンテナ
			対基地局アンテナ
			対移動局アンテナ
			同軸ケーブル
			基地局
			移動局
			無線周波数帯信号の時間スロット
			増幅回路の制御信号

【第1図】



【第3図】





【従来の技術】第8図は、例えば、特開平6-2168

2号 第1図に示された中継増幅器である。図において、(1)(2)は上り方向と下り方向の分岐を行うサークキュレーター、(3)(4)は増幅回路、(5)

(6)は入力レベル検出回路、(7)(8)は出力レベル検出回路、(9)は制御回路、(10)はFDMA/TDD(周波数分割多重/時分割同時送受話)、TDDA/TDD(時分割多重/時分割同時送受話)、あるいはCDMA(コード分割多重/時分割同時送受話)方式等(以下時分割同時送受話方式と称する)の基地局(57)の接続端子(同軸コネクタ等)、(53)は基地局(57)と接続端子(10)を接続する同軸ケーブル、(11)は対移動局アンテナ(52)の接続端子、

(58)は移動局である。先ず、基地局(57)が送信状態であり移動局(58)が受信状態にあるとする。基地局(57)からの信号はサークキュレーター(1)によって分岐され下り方向の増幅回路(3)に導かれるが、下り方向の入力レベル検出回路(5)が前記信号を検出した時点で増幅回路(3)の利得を増加すると同時に上り方向の増幅回路(4)の利得を減少させる。次に、移動局(58)が送信状態であり基地局(57)が受信状態にあるとする。下り方向の増幅回路(3)の利得は低下した状態とする。移動局(58)からの信号はサークキュレーター(2)によって分岐され上り方向の増幅回路(4)に導かれるが、上り方向の出力レベル検出回路(8)が信号を検出しないかぎり上り方向の増幅回路(4)の利得をそのままに保つが、上り方向の出力レベル検出回路(8)が信号を検出すると上り方向の増幅回路(4)の利得を減少させる。増幅回路(3)(4)の利得を減少させる度合は、出力レベル検出回路(8)の値と入力レベル検出回路(5)の差からサークキュレーター(2)のアイソレーションをアダプティブに推定して決める。

【0003】

【考案が解決しようとする課題】従来の双方向中継増幅器は以上のように構成されているので、基地局あるいは移動局が遠隔地に存在し何れもがアンテナを介して結合される場合には、基地局あるいは移動局からの入力信号が小さいため、入力信号の検出あるいは検出を確実にするための工夫が必要である。この発明は、上記のような問題点を改善するためになされたもので、基地局あるいは移動局からのフレーム同期信号や絶対スロット信号等を含んだデジタル信号を検出して同時送受話制御信号を再生し、制御回路により上り方向と下り方向の増幅器の利得の制御を行い、発振の無い安定な動作の双方向中継増幅器を提供することを目的とする。

【0004】

【課題を解決するための手段】この発明に係わる双方向中継増幅器は、時分割同時送受話方式の信号のように上り方向および下り方向の信号がともに同一周波数の場合でも、回り込みによる発振を抑圧して安定に双方向の中

継増幅が出来るよう、上り方向と下り方向の増幅器の利得を交互に切り替えて制御する。

【0005】

【作用】この発明において、基地局あるいは移動局からの無線周波数帯の信号からフレーム同期信号あるいは時間スロット信号あるいはその両方を含む信号から同時送受話制御信号を再生し、制御回路により上り方向と下り方向の増幅器の利得を制御することにより上り方向および下り方向の信号が同一周波数の場合でも発振せずに中継増幅することが出来る。

【0006】

【実施例】以下、この発明の一実施例を図にいて説明する。第1図において、(1)(2)は上り方向と下り方向の分岐を行うサークキュレーター等による分岐回路、

(3)(4)は増幅回路、(14)は入力レベルの結合回路、(9)は制御回路、(10)(11)は対基地局アンテナ(51)および対移動局アンテナ(52)との接続端子、(53)は基地局(57)のアンテナケーブル、(50)は基地局(57)のアンテナ、(12)

(13)は制御回路(9)と増幅回路(3)(4)の間のインターフェイス回路、(16)はデジタル信号検出回路、(21)(22)(23)は結合回路(14)の接続端子、(24)は検出回路(18)の接続端子、(58)は移動局である。

【0007】第1図において、定常状態では下り方向の増幅器(3)をON、上り方向の増幅器(4)をOFFに設定する。先ず、時分割同時送受話方式の基地局(57)から制御チャネル上で無線周波数帯の信号をアンテナ(50)から送出すると、この信号が対基地局アンテナ(51)で受信され、サークキュレーター等による分岐回路(1)により下り方向に分岐され、入力結合回路(14)により結合され、検出回路(18)によりデジタル信号が検出され当該検出出力が制御回路(9)に渡される。制御回路(9)は検出された信号からフレーム同期信号や絶対スロット信号等を取り出し、時分割同時送受話のための同期信号を再生し、インターフェイス回路(12)(13)を通じて増幅回路(3)および

(4)を利得あるいはON/OFFを制御する。一方、時分割同時送受話方式の移動局(58)からの信号が対移動局アンテナ(52)およびアンテナ端子(11)を経由して受信されると、サークキュレーター等による分岐回路(2)により上り方向に分岐され、増幅器(4)により増幅され、サークキュレーター等による分岐回路

(1)により分岐されて対基地局アンテナ(51)から送出される。時分割同時送受話方式の特徴として、送信周波数と受信周波数は同一であるが送信と受信が同時に行われることは無い、即ち、上り方向と下り方向に同時に信号が存在することは無い。本発明の制御回路(9)では、この時分割同時送受話方式の特徴を生かして増幅回路(3)および(4)の利得をアダプティブに制御



し、あるいは増幅回路(3)および(4)の電源のON/OFFを制御して、上り方向と下り方向の回り込みにより発生する発振を防止できるメリットがある。

【0008】第2図は、本発明の双方向中継増幅器の検出回路の実施例を示す構成図であり、結合回路(5)はフィルタ(29)および分岐回路(30)から構成され、デジタル信号検出回路(16)は低雑音増幅器(31)、ミキサ(32)、局発振器(33)、中間周波フィルター(34)、中間周波増幅器(35)デコーダ(36)とその出力端子(24a)、受信入力レベル検出回路(37)とその出力端子(24b)から構成される。なお、局発振器(33)は通算シセサイザで構成され、端子(24c)からのデーターによりチャネルが設定される。分岐回路(30)により分岐された信号は、低雑音増幅器(33)により増幅され、ミキサ(32)により基地局(57)からの無線周波数帯信号が中間周波数に変換され、中間周波フィルター(34)により選択され、中間周波増幅器(35)により増幅され、デコーダ(36)によりデジタル信号に変換されて端子(24a)から、また、受信入力レベルが検出回路(37)によって検出されて端子(24b)から制御回路(9)に送られる。

【0009】第3図は、本発明の同期信号の例を示す図であり、基地局(57)の制御信号(101)(103)あるいは移動局(58)からの時間スロット信号(102)に同期して下り方向および上り方向の増幅器(3)(4)の電源をON/OFFするための信号(104)(105)(106)が再生される。

【0010】第4図は、本発明の他の実施例を示す構成図であり、対基地局アンテナ(51a)(51b)および対移動局アンテナ(52a)(52b)が設けられ、各々のアンテナを距離を置いて設置することによって上り方向および下り方向のアイソレーションを大きくすることができ、増幅器(3)および(4)の結合による発振の余裕度を大きくすることが可能となる。

【0011】第5図は、本発明の他の実施例を示す構成図であり、結合回路(14)および(15)を介して検出回路(16)が接続される。本実施例により上り方向と下り方向のデジタル信号が検出でき、しかも、検出回路(16)が上り方向および下り方向で切り替えることにより共通に使えるようになり経済化が図れるメリットがある。

【0012】第6図は、本発明の他の実施例を示す構成図であり、結合回路(14)および(15)を介してデジタル信号の検出・送出路(39)が接続される。本実施例の検出・送出路(39)は、基地局(57)からのデジタル信号を検出する他に、例えば、基地局(57)からの監視信号にตอบสนองして、接続端子(27)、結合器(15)および上り方向の増幅器(4)を介してデジタル信号を上り方向に送信する手段を有する。当該検

出・送出路(39)は、対基地局アンテナ(51)から下り方向の増幅器(3)および上り方向の増幅器

(4)を介して接続されることによるので、当該双方方向中継増幅器の動作チェックを同時に行えるメリットがある。

【0013】第7図は、本発明の検出・送出路(39)の実施例を示す構成図であり、結合回路(14)の接続端子(23)を介してBPF(29a)により選択され、低雑音増幅器(31a)により増幅され、局発振器(33)およびミキサ(32a)により中間周波数に変換され、中間周波フィルター(34)により選択され、中間周波増幅器(35)により増幅され、デコーダ(36)によりデジタル信号に変換されて端子(28a)から、また、受信入力レベルが検出回路(37)により検出されて端子(28b)から制御回路(9)に送られる。一方、制御回路(9)から基地局(57)に向けて送出されるデジタル信号は、結合回路(15)の接続端子(28a)から印可され、デジタル信号の変調回路(38)により変調され、局発振器(33)およびミキサ(32b)により無線信号に変換され、電力増幅器(31b)、BPF(29b)、および端子(27)を介して結合器(6)に結合される。局発振器回路(33)の周波数は、制御回路(9)からのチャネル指定信号によって設定される。本構成により、下り方向の増幅器(3)および上り方向の増幅器(4)がデジタル信号の検出回路および送出路の一部を構成することが理解できる。

【0014】以上の説明では、デジタル信号の検出回路は下り方向の増幅回路の入力端子に接続するとしたが、下り方向と上り方向のどちらか一方あるいは両方に接続しても同様な効果が得られ、また、当該増幅回路の出力端子あるいは途中に設けても同様な効果が得られる。また、分岐回路はサークキュレーターによるものとしたが、電子スイッチ、ハイブリット回路、あるいは方向性結合器等を用いても同様な効果が得られる。また、制御回路は、DSP、マイコン、あるいはロジック回路あるいはこれらの組合せで構成しても同様な効果が得られる。制御手順についても一例を示した検出レベルあるいは検波出力により種々の制御手順が考えられる。また、増幅回路は上り方向と下り方向で個別に設けたが、一部あるいは全部を共通に使用することもできる。また、デジタル信号の検出・送出路の構成あるいは機能については代表的なものを示しており、他の構成あるいは機能が採用でき、挿入場所もこの限りではない。

#### 【0015】

【発明の効果】本発明は、上記のように構成されるため、基地局のサービスエリアを簡易な方法により屋内等に拡大することができ、双方向中継増幅器の動作チェックが可能となる。

【図面の簡単な説明】

【第1図】本発明の実施例を示す構成図である。

【第2図】本発明の双方向中継増幅器の検出回路の実施例を示す構成図である。

【第3図】本発明の同期信号の例を示す図である。

【第4図】本発明の他の実施例を示す構成図である。

【第5図】本発明の他の実施例を示す構成図である。

【第6図】本発明の他の実施例を示す構成図である。

【第7図】本発明の検出・送回路の実施例を示す構成図である。

【第8図】従来の双方向中継増幅器の構成図である。

【符号の説明】

1、2	サーキュレーター等の分岐器
3	下り方向の増幅回路
4	上り方向の増幅回路
5、6	検出回路
9	制御回路
10、10 a、10 b	双方向中継増幅器入力端子
11、11 a、11 b	双方向中継増幅器出力端子
12、13	制御回路インターフェイス
14、15	結合回路
16	デジタル信号検出回路
21、22、23	結合回路（14）の接続端子
24 a、24 b、24 c	制御回路（9）の接続端子
25、26、27	結合回路（15）の接続端子
28、28 a、28 b、	制御回路（9）の接続端子
28 c、28 d	同上

* 29、29 a、29 b	帯域通過フィルター
30	分岐器
31、31 a、31 b	低雑音増幅器
32、32 a、32 b	ミキサ
33	局発
34	中間周波フィルター
35	中間周波増幅器
36	デコーダ
37	入力レベル検出回路
38	デジタル変調回路
39	検出・送回路
50	基地局アンテナ
51、51 a、51 b	対基地局アンテナ
52、52 a、52 b	対移動局アンテナ
53	同軸ケーブル
57	基地局
58	移動局
101、102、103	無線周波数帯信号の時間スロット
104、105、106	増幅回路の制御信号

【手続補正2】

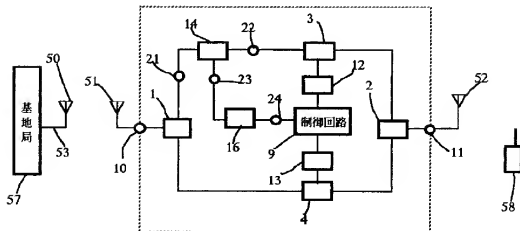
【補正対象書類名】図面

【補正対象項目名】全図

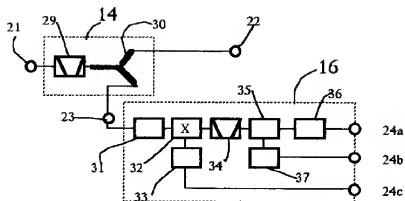
【補正方法】変更

【補正内容】

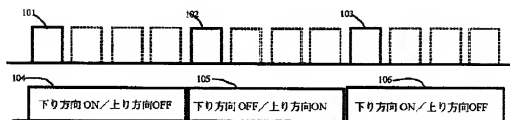
【第1図】



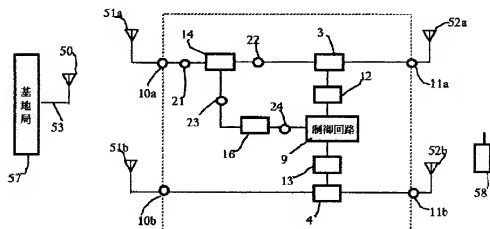
【第2図】



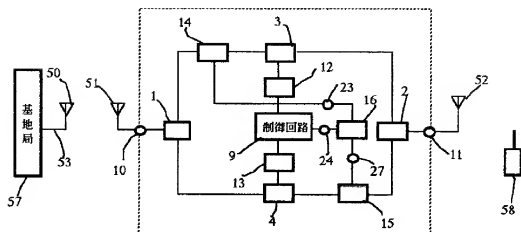
【第3図】



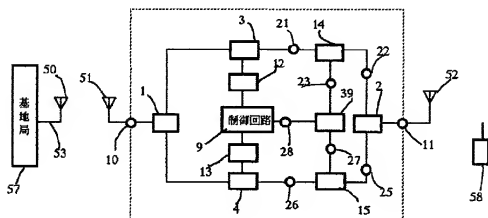
【第4図】



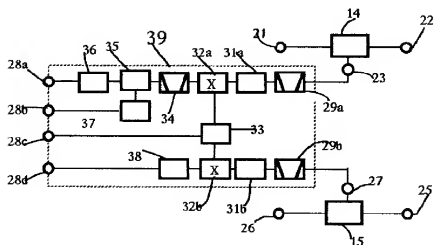
【第5圖】



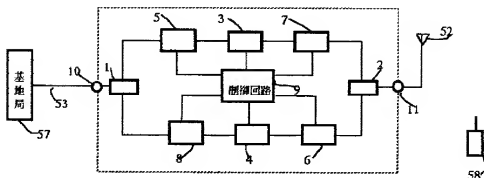
【第6圖】



【第7圖】



【第8図】



## 【系統補正書】

【提出日】平成8年1月2日

【系統補正1】

【補正対象書類名】明細書

【補正対象項目名】0013

【補正方法】変更

【補正内容】

【0013】第7図は、本発明の検出・送回路（39）の実施例を示す構成図である。基地局から送出されたデジタル信号は、分岐器（2）を通った後、共通に設けられた結合回路（14）（15）の接続端子（23）（27）を介して、同じく共通に設けられたBPF（29a）（29b）により選択され、切り替え回路（40）により切り替えられ、局発発振器（33）およびミキサ（32a）により中間周波数に変換され、中間周波フィルタ（34）により選択され、中間周波増幅器（35）により増幅され、デコーダ（36）によりデジタル信号に変換されて端子（28a）から、まだ、受信入力レベルが検出回路（37）によって検出されて端子（28b）から制御回路（9）に送られる。一方、制御回路（9）から基地局（57）に向けて送出されるデジタル信号は、接続端子（28d）から印可され、デジタル信号の変調回路（38）により変調され、局発発振器（33）およびミキサ（32b）により無線信号に変換され、切り替え回路（40）により切り替えられ、共通に設けられたBPF（29a）（29b）により選択され、端子（23）（27）を介して、同じく共通に設けられた結合回路（14）（15）に結合され、分岐器（2）を通った後上り方向の増幅器（4）により増幅される。局発発振回路（33）の周波数は、制御回路（9）からのチャネル指定信号によって設定される。本構成により、下り方向の増幅器（3）および上り方向の増幅器（4）がデジタル信号の検出回路および送回路の一部を構成することが理解できる。また、第6図に比

較して結合器（14）（15）、BPF（29a）（29b）が共通に設けられ、切り替え回路（40）により切り替えられていることが分かる。

【系統補正2】

【補正対象書類名】明細書

【補正対象項目名】0014

【補正方法】変更

【補正内容】

【0014】以上の説明では、デジタル信号の検出回路は下り方向の増幅回路の入力端子に接続するとしたが、下り方向と上り方向のどちらか一方あるいは両方に接続しても同様な効果が得られ、また、当該増幅回路の出力端子あるいは途中に設けても同様な効果が得られる。また、分岐回路はサークュレーターによるものとしたが、電子スイッチ、ハイブリット回路、あるいは方向性結合器等を用いても同様な効果が得られる。また、制御回路は、DSP、マイコン、あるいはロジック回路あるいはこれらの組合せで構成しても同様な効果が得られる。制御手順についても一例を示したが検出レベルあるいは検波出力により種々の制御手順が考えられる。また、増幅回路は上り方向と下り方向で個別に設けたが、一部あるいは全部を共通に使用することもできる。また、デジタル信号の検出あるいは送回路の構成あるいは機能については代表的なものを示しており他の構成あるいは機能が採用でき、結合あるいは挿入場所もこの限りではない。

【系統補正3】

【補正対象書類名】明細書

【補正対象項目名】符号の説明

【補正方法】変更

【補正内容】

【符号の説明】

1、2

サークュレーター等の分岐器

